WHAT IS CLAIMED IS:

1. A permanent magnet rotating electric machine for a vehicle, comprising:

a stator having stator windings wound concentratively;

a rotor held rotatably inside said stator and having a rotor core formed of a plurality of laminated steel plates;

a plurality of holes arranged circumferentially about said rotor core radially inwardly from a perimeter in a radial direction thereof;

a plurality of permanent magnets arranged in said plurality of holes with alternately reversing polarity at each pole respectively;

magnetic pole piece areas provided at said rotor core, radially outward of said permanent magnets;

auxiliary magnetic pole areas disposed at said rotor core, between said permanent magnets of said pole so as to generate a reluctance torque; wherein,

said stator and rotor are configured so as to generate a rotational torque based on a torque generated by said permanent magnets and on said reluctance torque;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor; and

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings.

2. A permanent magnet rotating electric machine for a vehicle driven by electric power of a battery carried on the vehicle, said machine comprising:

a stator having a stator core on which stator windings are wound concentratively;

a rotor having a laminated rotor core, and held rotatably inside said stator;

a plurality of permanent magnets inserted in a plurality of holes provided in said rotor core, with alternately reversing polarity at each pole respectively;

magnetic pole piece areas provided at an outer periphery of said rotor core; and

auxiliary magnetic pole areas provided at said rotor core between said permanent magnets of each pole, for generating a reluctance torque; wherein,

said magnetic pole piece areas in said laminated rotor core ease pulsated magnetic flux acting from said stator to said permanent magnets;

said stator and rotor are configured to provide a rotational torque based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator via said magnetic pole piece areas and said reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor; and

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings.

3. A permanent magnet rotating electric machine for a vehicle comprising:

a stator having a plurality of stator cores on which multi-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of permanent magnets inserted in a plurality of holes arranged circumferentially about said rotor core, with a polarity at each respective pole being opposite that of circumferentially adjacent magnets;

magnetic pole piece areas provided at an outer periphery of said rotor core; and

auxiliary magnetic pole areas provided at said rotor core, between said permanent magnets of each pole; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator via said magnetic pole piece areas and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

further. same phase, windings are wound around a plurality of stator salient poles; and

a winding wound on at least one of said plurality of stator salient poles for which same-phase winding are wound has a phase difference of voltage for the other same-phase winding.

4. A permanent magnet rotating electric machine for a vehicle driven by an electric power of a battery carried on the vehicle, comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of holes disposed circumferentially about said rotor core;

a plurality of permanent magnets inserted in said plurality of holes, with alternating polarity at each respective pole relative to its circumferential neighbors; and

auxiliary magnetic pole areas provided between said permanent magnets of each pole; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

further, same phase, windings are wound around a plurality of stator salient poles; and

a winding wound on at least one of said plurality of stator salient poles on which same-phase winding are wound has a phase difference of voltage for the other same-phase winding.

5. A permanent magnet rotating electric machine for a vehicle driven by electric power of a battery carried on the vehicle, said machine, comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively, and having a plurality of stator salient poles;

a rotor held rotatably inside said stator, and having a rotor core;

a plurality of permanent magnets arranged circumferentially about said rotor core, counter to said stator salient poles, with alternately opposite polarity in the circumferential direction; and

auxiliary magnetic pole areas provided at said rotor core, between said permanent magnets of each pole; wherein,

a rotational torque is generate based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

the relationship $M:P = 6n : 6n \pm 2$ or $M:P = 3n : 3n \pm 2$ is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer.

6. A permanent magnet rotating electric machine according to Claim 5, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

7. A permanent magnet rotating electric machine for a vehicle driven by electric power of a battery carried on the vehicle, said machine, comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively, and having a plurality of stator salient poles:

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of circumferentially disposed holes provided at said rotor core;

a plurality of permanent magnets inserted in said plurality of holes, counter to said stator salient poles and having alternating polarity at each respective pole relative to its neighbors; and

auxiliary magnetic pole areas provided at areas between said permanent magnets of each pole; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings; and

the relationship $M:P = 6n : 6n \pm 2$ or $M:P = 3n : 3n \pm 2$ is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer.

8. A permanent magnet rotating electric machine according to Claim 7, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

9. A permanent magnet rotating electric machine for a vehicle driven by electric power of a power source carried on the vehicle, said machine comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of permanent magnets inserted in a plurality of holes arranged circumferentially about said rotor core, with alternately reversing polarity at each respective pole; and

auxiliary magnetic pole areas provided between said permanent magnets of each neighboring pole of said rotor core; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

further, same phase, windings are wound around a plurality of stator salient poles; and

a winding wound on at least one of said plurality of stator salient poles on which same-phase winding are wound has a phase difference of voltage for the other same-phase winding; and

the relationship M:P = 6N : 6n ± 2 or M:P = 3n : 3n ± 2 is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer.

10. A permanent magnet rotating electric machine according to Claim 9, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

11. A permanent magnet rotating electric machine for a vehicle driven by a battery carried on the vehicle, said machine comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of permanent magnets inserted in a plurality of holes that are arranged circumferentially about said rotor core, with each respective magnet having a polarity opposite that of circumferentially adjacent magnets; and

auxiliary magnetic pole areas provided between said permanent magnets of each neighboring pole; wherein,

magnetic pole piece areas are provided at said rotor core, radially outward of said permanent magnets;

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator via said magnetic pole piece areas and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

further, same phase windings, are wound around a plurality of stator salient poles;

a winding wound on at least one of said plurality of stator salient poles on which same-phase winding are wound has a phase difference of voltage for the other same-phase winding; and

the relationship $M:P = 6N : 6n \pm 2$ or $M:P = 3n : 3n \pm 2$ is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer.

12. A permanent magnet rotating electric machine according to Claim 11, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

13. An automobile having a DC power source, a permanent magnet rotating electric machine and a control circuit, wherein said permanent magnet rotating electric machine comprises:

a stator having stator windings wound concentratively;

a rotor held rotatably inside said stator and having a rotor core formed of a plurality of laminated steel plates;

a plurality of holes arranged circumferentially about said rotor core, radially inwardly from a perimeter in a radial direction thereof;

a plurality of permanent magnets arranged in said plurality of holes with alternately reversing polarity at each pole respectively;

magnetic pole piece areas provided at said rotor core, radially outward of said permanent magnets;

auxiliary magnetic pole areas disposed at said rotor core, between said permanent magnets of each pole so as to generate a reluctance torque; wherein,

said stator and rotor are configured so as to generate a rotational torque based on a torque generated by said permanent magnets and on said reluctance torque;

said DC power source supplies current to said stator winding through said control circuit;

said automobile further comprises magnet pole position detecting means for detecting a position of said permanent magnet of said rotor; and

said control circuit generates magnetic flux to said stator winding by controlling a current flowing through said stator winding based on a position of said permanent magnet detected by said magnet pole position detecting means, generates said reluctance torque by said magnetic flux at said auxiliary magnetic pole areas, and controls said permanent magnet rotating electric machine by field weakening control at a high rotational speed of said permanent magnet rotating electric machine.

14. An automobile having a battery for supplying electric power, a permanent magnet rotating electric machine and a control circuit for controlling an electric power supplied to said permanent magnet rotating electric machine, wherein said permanent magnet rotating electric machine comprises:

a stator having a stator core on which stator windings are wound concentratively;

a rotor having a laminated rotor core, and held rotatably inside said stator;

a plurality of permanent magnets inserted in a plurality of holes provided in said rotor core, with alternately reversing polarity at each pole respectively;

magnetic pole piece areas provided at an outer periphery of said rotor core; and

auxiliary magnetic pole areas provided at said rotor core, between said permanent magnets of each pole, for generating a reluctance torque; wherein,

said magnetic pole piece areas in said laminated rotor core ease pulsated magnetic flux acting from said stator to said permanent magnets;

said stator and rotor are configured to provide a rotational torque based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator via said magnetic pole piece areas and said reluctance torque generated by said auxiliary magnetic pole areas;

said automobile further comprises magnet pole position detecting means for detecting a position of said permanent magnet of said rotor; and

said control circuit generates magnetic flux to said stator winding by controlling a current flowing through said stator winding based on a position of said permanent magnet detected by said magnet pole position detecting means, generates a reluctance torque by said magnetic flux at said auxiliary magnetic pole areas, and controls current supplied to said stator winding such that a rotational torque at a low rotational speed of said permanent magnet rotating electric machine is smaller than rotational torque at a high rotational speed.

15. An automobile having a DC power source, a permanent magnet rotating electric machine and a control circuit, wherein said permanent magnet rotating electric machine comprises:

a stator having a plurality of stator cores on which multi-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of permanent magnets inserted in a plurality of holes arranged circumferentially about said rotor core, a polarity at each respective pole being opposite that of circumferentially adjacent magnets;

magnetic pole piece areas provided at an outer periphery of said rotor core; and

auxiliary magnetic pole areas provided at said rotor core, between said permanent magnets of each pole; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator via said magnetic pole piece areas and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

said automobile further comprises magnet pole position detecting means for detecting a position of said permanent magnet of said rotor; and

said control circuit generates magnetic flux to said stator winding by controlling a current flowing through said stator winding based on a position of said permanent magnet detected by said magnet pole position detecting means, generates said reluctance torque by said magnetic flux at said auxiliary magnetic pole areas, and controls an electric power supplied to said permanent magnet rotating electric machine by a field weakening control.

16. An automobile having a battery for supplying electric power, a permanent magnet rotating electric machine and a control circuit for controlling electric power supplied to said permanent magnet rotating electric machine, wherein said permanent magnet rotating electric machine comprises:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of circumferentially disposed holes provided at said rotor core;

a plurality of permanent magnets inserted in a plurality of holes provided at said rotor core so as to be changed a polarity at each pole alternative, and

auxiliary magnetic pole areas provided between said permanent magnets of each pole; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

said automobile further comprises magnet pole position detecting means for detecting a position of said permanent magnet of said rotor; and

said control circuit generates magnetic flux to said stator winding by controlling a current flowing through said stator winding based on a position of said permanent magnet detected by said magnet pole position detecting means, generates a reluctance torque by said magnetic flux at said auxiliary magnetic pole areas, and controls an electric power supplied to said permanent magnet rotating electric machine by a field weakening control.

17. An automobile having a battery for supplying electric power, a permanent magnet rotating electric machine and a control circuit for controlling electric power supplied to said permanent magnet rotating electric machine, said electric machine comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively, and having a plurality of stator salient poles;

a rotor held rotatably inside said stator, and having a rotor core;

a plurality of permanent magnets arranged circumferentially about said rotor core, counter to said stator salient poles, with alternately opposite polarity in the circumferential direction; and

auxiliary magnetic pole areas provided at said rotor core, between said permanent magnets of each pole; wherein,

a rotational torque is generate based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

the relationship $M:P = 6n : 6n \pm 2$ or $M:P = 3n : 3n \pm 2$ is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer;

said automobile further comprises magnet pole position detecting means for detecting a position of said permanent magnet of said rotor; and

said control circuit generates magnetic flux to said stator winding by controlling a current flowing through said stator winding based on a position of said permanent magnet detected by said magnet pole position detecting means, generates said reluctance torque by said magnetic flux at said auxiliary magnetic pole areas, and controls an electric power supplied to said permanent magnet rotating electric machine by a field weakening control.

18. An automobile according to Claim 17, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

19. An automobile having a battery for supplying electric power, a permanent magnet rotating electric machine driven by said electric power, and a control circuit for controlling electric power supplied to said permanent magnet rotating electric machine, wherein said permanent magnet rotating electric machine comprises:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively:

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of circumferentially disposed holes provided at said rotor core;

a plurality of permanent magnets inserted in said plurality of holes, counter to said stator salient poles and having alternating polarity at each respective pole relative to its neighbors; and

auxiliary magnetic pole areas provided at areas between said permanent magnets of each pole; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings; and

the relationship $M:P = 6n : 6n \pm 2$ or $M:P = 3n : 3n \pm 2$ is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer;

said automobile further comprises magnet pole position detecting means for detecting a position of said permanent magnet of said rotor; and

said control circuit generates magnetic flux to said stator winding by controlling a current flowing through said stator winding based on a position of said permanent magnet detected by said magnet pole position detecting means, generates a reluctance torque by said magnetic flux at said auxiliary magnetic pole areas, and controls an electric power supplied to said permanent magnet rotating electric machine by a field weakening control.

20. An automobile according to Claim 19, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

21. An automobile having a power source for supplying electric power, a permanent magnet rotating electric machine driven by said electric power of said power source, and a control circuit for controlling electric power supplied to said permanent magnet rotating electric machine, wherein said permanent magnet rotating electric machine comprises:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of permanent magnets inserted in a plurality of holes arranged circumferentially about said rotor core, with alternately reversing polarity at each respective pole; and

auxiliary magnetic pole areas provided between said permanent magnets of each neighboring pole of said rotor core; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

further, same phase, windings are wound around a plurality of stator salient poles; and

a winding wound on at least one of said plurality of stator salient poles on which same-phase winding are wound has a phase difference of voltage for the other same-phase winding; and

the relationship $M:P = 6N : 6n \pm 2$ or $M:P = 3n : 3n \pm 2$ is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and <u>n</u> is a positive integer; and

said automobile further comprises magnet pole position detecting means for detecting a position of said permanent magnet of said rotor; and

said control circuit generates magnetic flux to said stator winding by controlling a current flowing through said stator winding based on a position of said permanent magnet detected by said magnet pole position detecting means, generates a reluctance torque by said magnetic flux at said auxiliary magnetic pole areas, and controls an electric power supplied to said permanent magnet rotating electric machine by a field weakening control.

22. An automobile according to Claim 21, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

23. An automobile having a battery for supplying an electric power, a permanent magnet rotating electric machine driven by said electric power, and a control circuit for controlling an electric power supplied to said permanent magnet rotating electric machine, wherein said permanent magnet rotating electric machine comprises:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of permanent magnets inserted in a plurality of holes that are arranged circumferentially about said rotor core, with each respective

magnet having a polarity opposite that of circumferentially adjacent magnets; and

auxiliary magnetic pole areas provided between said permanent magnets of each neighboring pole; wherein,

magnetic pole piece areas are provided at said rotor core, radially outward of said permanent magnets;

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator via said magnetic pole piece areas and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator windings generate magnetic flux by receiving current that is controlled in response to a position of said permanent magnets of said rotor;

said auxiliary magnetic pole areas generate said reluctance torque by said magnetic flux generated by said stator windings;

further, same phase windings, are wound around a plurality of stator salient poles;

a winding wound on at least one of said plurality of stator salient poles on which same-phase winding are wound has a phase difference of voltage for the other same-phase winding; and

the relationship $M:P = 6N : 6n \pm 2$ or $M:P = 3n : 3n \pm 2$ is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer; and

said automobile further comprises magnet pole position detecting means for detecting a position of said permanent magnet of said rotor; and

said control circuit generates magnetic flux to said stator winding by controlling a current flowing through said stator winding based on a position of said permanent magnet detected by said magnet pole position detecting means, generates a reluctance torque by said magnetic flux at said auxiliary magnetic pole areas, and controls said permanent magnet rotating electric machine by a field weakening control at a high rotational speed of said permanent magnet rotating electric machine.

24. An automobile according to Claim 23, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

25. A permanent magnet rotating electric machine according to Claim 1, wherein:

said rotor receives current controlled by a weakening field control so that a current phase is advanced at a high rotational speed of said permanent magnet rotating electric machine compared with current phase at a low rotational speed, and generates magnetic flux by supplied current.

26. A permanent magnet rotating electric machine for a vehicle driven by electric power of a battery carried on the vehicle, said machine comprising:

a stator having a stator core on which stator windings are wound concentratively;

a rotor having a laminated rotor core, and held rotatably inside said stator;

a plurality of permanent magnets inserted in a plurality of holes provided in said rotor core, with alternately reversing polarity at each pole respectively;

magnetic pole piece areas provided at an outer periphery of said rotor core; and

auxiliary magnetic pole areas provided at said rotor core between said permanent magnets of each pole, for generating a reluctance torque; wherein,

said magnetic pole piece areas in said laminated rotor core ease pulsated magnetic flux acting from said stator to said permanent magnets;

said stator and rotor are configured to provide a rotational torque based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator via said magnetic pole piece areas and said reluctance torque generated by said auxiliary magnetic pole areas; and

said stator receives current controlled by a weakening field control such that a current phase at a high rotational speed of said permanent magnet rotating electric machine is advanced compared with a current phase at a low rotational speed, and generates magnetic flux by supplied current.

27. A permanent magnet rotating electric machine for a vehicle driven by electric power of a battery carried on the vehicle, said machine comprising:

a stator having a plurality of stator cores on which multi-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of permanent magnets inserted in a plurality of holes arranged circumferentially about said rotor core, with a polarity at each respective pole being opposite that of circumferentially adjacent magnets;

magnetic pole piece areas provided at an outer periphery of said rotor core; and

auxiliary magnetic pole areas provided at said rotor core, between said permanent magnets of each pole; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator via said magnetic pole piece areas and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator receives current controlled by a weakening field control so that a current phase is advanced at a high rotational speed of said permanent magnet rotating electric machine compared with a current phase at a low rotational speed of that, and generates magnetic flux by supplied current;

said auxiliary magnetic pole areas generate said reluctance torque by a magnetic flux generated by said rotor windings;

further, same phase, windings are wound around a plurality of stator salient poles; and

a winding wound on at least one of said plurality of stator salient poles for which same-phase winding are wound has a phase difference of voltage for the other same-phase winding.

28. A permanent magnet rotating electric machine for a vehicle driven by an electric power of a battery carried on the vehicle, said machine comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of holes disposed circumferentially about said rotor core;

a plurality of permanent magnets inserted in said plurality of holes, with alternating polarity at each respective pole relative to its circumferential neighbors; and

auxiliary magnetic pole areas provided between said permanent magnets of each pole; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator receives current controlled by a weakening field control so that a current phase is advanced at a high rotational speed of said permanent magnet rotating electric machine compared with a current phase at a low rotational speed of that, and generates magnetic flux by supplied current;

said auxiliary magnetic pole areas generate said reluctance torque by a magnetic flux generated by said stator windings;

further, same phase, windings are wound around a plurality of stator salient poles; and

a winding wound on at least one of said plurality of stator salient poles for which same-phase winding are wound has a phase difference of voltage for the other same-phase winding.

29. A permanent magnet rotating electric machine for a vehicle driven by an electric power of a battery carried on the vehicle, said machine comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively, and having a plurality of stator salient poles;

a rotor held rotatably inside said stator, and having a rotor core;

a plurality of permanent magnets arranged circumferentially about said rotor core, counter to said stator salient poles, with alternately opposite polarity in the circumferential direction; and

auxiliary magnetic pole areas provided at said rotor core, between said permanent magnets of each pole; wherein,

a rotational torque is generate based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator receives current controlled by weakening field control so that a current phase is advanced at a high rotational speed of said permanent magnet rotating electric machine compared with current phase at a low rotational speed, and generates magnetic flux by supplied current;

said auxiliary magnetic pole areas generate said reluctance torque by magnetic flux generated by said stator windings; and

the relationship $M:P = 6N : 6n \pm 2$ or $M:P = 3n : 3n \pm 2$ is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer.

30. A permanent magnet rotating electric machine according to Claim 29, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

31. A permanent magnet rotating electric machine for a vehicle driven by electric power of a battery carried on a vehicle, said machine comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively, and having a plurality of stator salient poles:

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of circumferentially disposed holes provided at said rotor core;

a plurality of permanent magnets inserted in said plurality of holes, counter to said stator salient poles and having alternating polarity at each respective pole relative to its neighbors; and

auxiliary magnetic pole areas provided at areas between said permanent magnets of each pole; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator receives current controlled by weakening field control so that a current phase is advanced at a high rotational speed of said permanent magnet rotating electric machine compared with current phase at a low rotational speed, and generates magnetic flux by supplied current,

said auxiliary magnetic pole areas generate said reluctance torque by a magnetic flux generated by said stator windings; and

the relationship M:P = 6N : 6n ± 2 or M:P = 3n : 3n ± 2 is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer.

32. A permanent magnet rotating electric machine according to Claim 31, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

33. A permanent magnet rotating electric machine for a vehicle driven by electric power of a power source carried on the vehicle, said machine comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of permanent magnets inserted in a plurality of holes arranged circumferentially about said rotor core, with alternately reversing polarity at each respective pole; and

auxiliary magnetic pole areas provided between said permanent magnets of each neighboring pole of said rotor core; wherein,

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator receives current controlled by weakening field control so that a current phase is advanced at a high rotational speed of said permanent magnet rotating electric machine compared with current phase at a low rotational speed, and generates magnetic flux by supplied current;

said auxiliary magnetic pole areas generate said reluctance torque by a magnetic flux generated by said stator windings;

further, same phase, windings are wound around a plurality of stator salient poles;

a winding wound on at least one of said plurality of stator salient poles on which same-phase winding are wound has a phase difference of voltage for the other same-phase winding; and

the relationship M:P = 6N : 6n ± 2 or M:P = 3n : 3n ± 2 is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer.

34. A permanent magnet rotating electric machine according to Claim 33, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

35. A permanent magnet rotating electric machine for a vehicle driven by a battery carried on the vehicle, said machine comprising:

a stator having a plurality of stator cores on which three-phase windings are wound concentratively;

a rotor held rotatably inside said stator, and having a rotor core formed of a plurality of laminated silicon steel plates;

a plurality of permanent magnets inserted in a plurality of holes that are arranged circumferentially about said rotor core, with each respective magnet having a polarity opposite that of circumferentially adjacent magnets; and

auxiliary magnetic pole areas provided between said permanent magnets of each neighboring pole; wherein,

magnetic pole piece areas are provided at said rotor core, radially outward of said permanent magnets;

a rotational torque is generated based on a torque generated in response to a magnetic flux acting from said permanent magnets to said stator via said magnetic pole piece areas and a reluctance torque generated by said auxiliary magnetic pole areas;

said stator receives current controlled by weakening field control so that a current phase is advanced at a high rotational speed of said permanent

magnet rotating electric machine compared with current phase at a low rotational speed, and generates magnetic flux by supplied current,

said auxiliary magnetic pole areas generate said reluctance torque by a magnetic flux generated by said stator windings;

further, same phase, windings are wound around a plurality of stator salient poles;

a winding wound on at least one of said plurality of stator salient poles on which same-phase winding are wound has a phase difference of voltage for the other same-phase winding; and

the relationship $M:P = 6N : 6n \pm 2$ or $M:P = 3n : 3n \pm 2$ is satisfied, where M is the number of said stator salient poles, P is the number of said permanent magnets, and n is a positive integer.

36. A permanent magnet rotating electric machine according to Claim 35, wherein the number of the poles of said rotor having said permanent magnets is one of eight and ten.

37. An automobile having a DC power source, a permanent magnet rotating electric machine and a control circuit according to Claim 13, wherein said control circuit controls said permanent magnet rotating electric machine by field weakening control, such that a current phase is advanced at high rotational speed of said permanent magnet rotating electric machine compared with

current phase at a low rotational speed of said machine, and generates magnetic flux by supplied current.

38. The automobile according to Claim 14, wherein said control circuit controls current supplying to said stator winding such that a current phase at a high rotational speed of said permanent magnet rotating electric machine is advanced compared with current phase at a low rotational speed of that, and generates magnetic flux by supplied current.